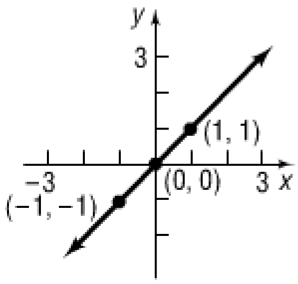
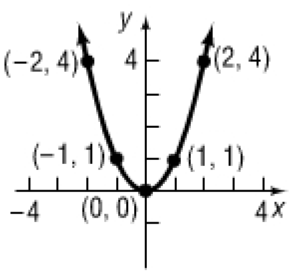
# Library of Functions; Piecewise-Defined Functions

**Identity Function**
$f(x) = x$



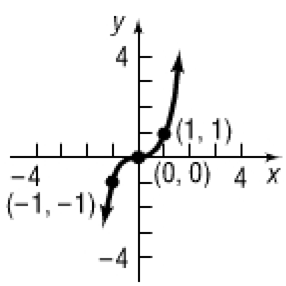

- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Line with slope of $m = 1$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Bisects Quadrants I and III
- Key Points: $(-2,-2)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(2,2)$

**Square Function**
$f(x) = x^2$



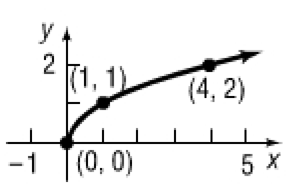

- Domain: $\mathbb{R}$
- Range: $[0,\infty)$
- Parabola
- Intercept: $(0,0)$
- Even Function
- Decreasing on $(-\infty,0)$ and increasing on $(0,\infty)$
- Key Points: $(-2,4)$, $(-1,1)$, $(0,0)$, $(1,1)$, $(2,4)$

**Cube Function**
$f(x) = x^3$




- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Key Points: $(-2,-8)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(2,8)$

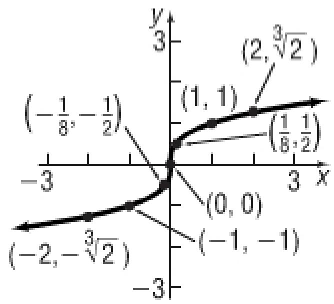
**Square Root Function**
$f(x) = \sqrt{x}$




- Domain: $[0,\infty)$
- Range: $[0,\infty)$
- Intercept: $(0,0)$
- Neither even nor odd
- Increasing on $[0,\infty)$
- Minimum value of 0 at $x = 0$
- Key Points: $(0,0)$, $(1,1)$, $(4,2)$, $(9,3)$

**Cube Root Function**

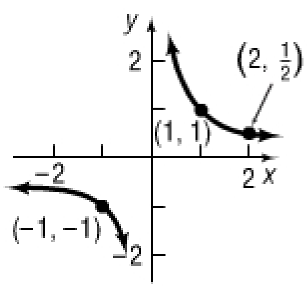
$f(x) = \sqrt[3]{x}$




- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Key Points: $(-8,-2)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(8,2)$

**Reciprocal Function**

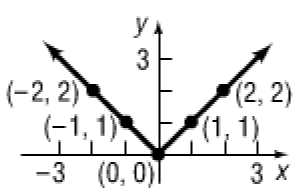
$f(x) = \dfrac{1}{x}$




- Domain: $(-\infty,0)\cup(0,\infty)$
- Range: $(-\infty,0)\cup(0,\infty)$
- No Intercepts
- Odd Function
- Decreasing on $(-\infty,0)$ and $(0,\infty)$
- Key Points: $(-2,-\frac{1}{2})$, $(-1,-1)$, $(-\frac{1}{2},-2)$, $(\frac{1}{2},2)$, $(1,1)$, $(2,\frac{1}{2})$

**Absolute Value Function**

$f(x) = |x|$




- Domain: $\mathbb{R}$
- Range: $[0,\infty)$
- Intercept: $(0,0)$
- Even Function
- Decreasing on $(-\infty,0)$ and increasing on $(0,\infty)$
- Minimum value of 0 at $x = 0$
- Key Points: $(-2,2)$, $(-1,1)$, $(0,0)$, $(1,1)$, $(2,2)$

**Graphing Piecewise-Defined Functions**

Sometimes a function is defined differently on different parts of its domain. When functions are defined by more than one equation, they are called ***piecewise-defined functions*.**

**Examples:** For the following functions:

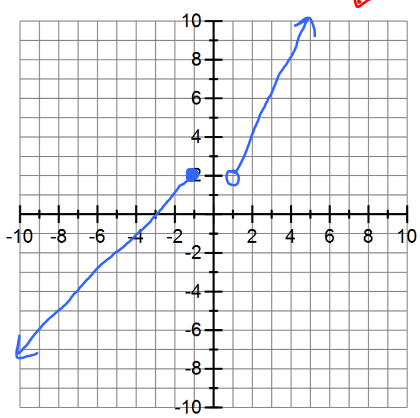
a) Graph the function.

b) Find the domain and range of the function.

c) Locate any intercepts.

d) State whether the function is continuous on its domain.

1) $f(x) = \begin{cases} x+3 & \text{if } x \le -1 \\ 2x & \text{if } x > 1 \end{cases}$



b) Domain: $(-\infty, -1] \cup (1, \infty)$

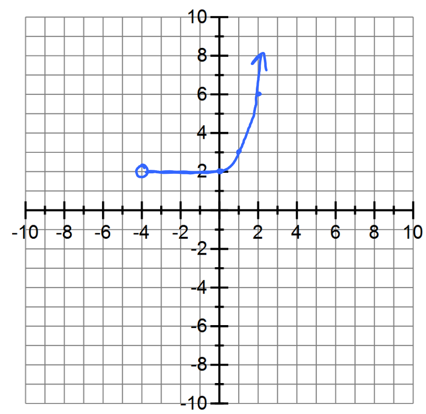
Range: $(-\infty, \infty)$

c) x-int: $(-3, 0)$. No y-int

d) not continuous

2) $f(x) = \begin{cases} 2 & \text{if } -4 < x < 0 \\ x^2 + 2 & \text{if } x \ge 0 \end{cases}$

If closed circle overlaps open circle, there is a point in that location. Use a closed circle



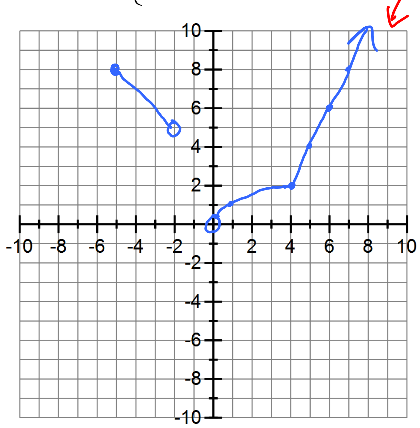
b) Domain: $(-4, \infty)$

Range: $[2, \infty)$

c) y-int: $(0, 2)$. No x-int.

d) continuous

3) $f(x) = \begin{cases} 3-x & \text{if } -5 \le x < -2 \\ \sqrt{x} & \text{if } 0 < x < 4 \\ 2x-6 & \text{if } x \ge 4 \end{cases}$



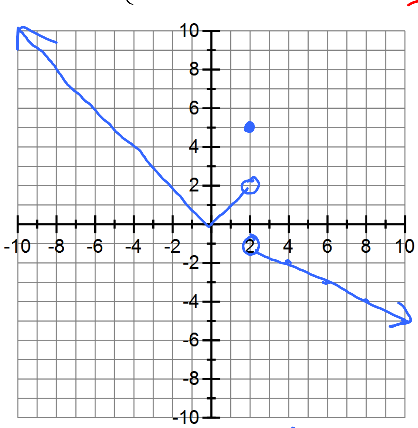
b) Domain: $[-5, -2) \cup (0, \infty)$

Range: $(0, \infty)$

c) No intercepts

d) Not continuous

4) $f(x) = \begin{cases} |x| & \text{if } x < 2 \\ 5 & \text{if } x = 2 \\ -\frac{1}{2}x & \text{if } x > 2 \end{cases}$



b) Domain: $(-\infty, \infty)$

Range: $(-\infty, -1) \cup [0, \infty)$

c) x & y-int: $(0, 0)$

d) not continuous